

REMARKS

The above amendment to Claim 1 serves to clarify the presently claimed invention. More specifically, this amendment clarifies that (1) the product mixture which is phosgenated in step (c) comprises a mixture of polyamines of the diphenylmethane series, HCl, no more than 10 wt. % of aniline and no more than 5 wt.% of water; and (2) the acidic catalyst (i.e. the HCl) is not neutralized in the process according to the present invention. Support for these amendments can be found in the original specification on page 5, lines 11-14 and lines 17-19 and on page 9, lines 29-30. The amendments to Claims 4, 5 and 6 only serve to correct an inadvertent typographical error in the language of these claims.

Applicants respectfully submit that no new matter has been added by any of these amendments.

Claims 1-9 were rejected under 35 U.S.C. 103(a) as being unpatentable over DE 2404775 (the Fuchs et al reference), or GB 1203546 (the Hoeschele reference), or the Konig et al reference (U.S. Patent 5,310,769), or the Keggenhoff et al reference (U.S. Patent 4,597,909). For convenience, an English translation of DE 2404775 is enclosed.

DE 2404775 (the Fuchs et al reference) discloses a method for the manufacture of diphenylmethane diisocyanate containing polymethylene polyphenyl isocyanates. This method comprises condensing (in a first step) aniline and aqueous formaldehyde in the presence of hydrochloric acid, distilling the reaction mixture without neutralization while separating and, optionally, recycling water and/or non-converted aniline; and transferring (in a second step) the non-neutralized polyamine/polyamine hydrochloride mixture from the first step in liquid hydrogen chloride as a suspension means to polyamine hydrochloride, and adding liquid phosgene to convert the polyamine hydrochloride to polyisocyanate.

GB 1,203,546 (the Hoeschele reference) discloses a polyisocyanate composition which is suitable for the production of rigid foams. This polyisocyanate composition is prepared by (1) reacting at least 2.5 moles of aniline with 1 mole of formaldehyde in the presence of a mineral acid, forming an intermediate methylene-bridged polyphenyl polyamide mixture, (2) removing the methylenedianiline (MDA)

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from the intermediate polyamine mixture to leave a polyamine residue which contains no more than 55% by weight of methylenedianiline, and (3) phosgenating this polyamine residue to yield the corresponding polyisocyanate composition. (See page 1, lines 70-82.)

A process for the production of polyamine mixtures of the polyamino-polyaryl-polymethylene series is disclosed by the Konig et al reference (U.S. Patent 5,310,769). This process comprises condensing aniline with formaldehyde, continuing this condensation reaction in the presence of an acid catalyst, neutralizing the acid catalyst after the condensation reaction is completed, and purifying the resultant polyamine mixtures by distillation to remove excess aromatic amines. The purified polyamine mixtures can then be phosgenated to yield the corresponding polyisocyanates of the diphenylmethane series. (See column 1, line 51 through column 2, line 16; column 4, lines 41-47; and Claim 1 at column 6, lines 13-37.)

The Keggenhoff et al reference (U.S. Patent 4,597,909) discloses a process for the production of polyisocyanates. In particular, this process comprises (a) reacting 2.0 to 3.5 moles of aniline with 1 mole of formaldehyde in the presence of HCl or a condensation product of aniline and formaldehyde produced in the absence of acid catalyst is reacted in the presence of HCl at the specified degree of protonation and temperature, (b) adding more aniline to the reaction mixture so that the molar ratio of amine nitrogen atoms in the form of free aniline and the reaction products formed in accordance with (a) to formaldehydes chemically bound in the form of methylene bridges in the reaction products increases to more than 10:1 and up to 20:1, with the degree of protonation decreasing accordingly, (c) heating the reaction mixture from (b) to allow the N-substituted intermediate products present to be completely rearranged into polyamines containing unsubstituted primary amino groups and (d) distilling the reaction mixture from (c) after neutralization of the acid. The resultant polyamines may then be phosgenated to form polyisocyanates of the diphenylmethane series. (See column 2, line 39 through column 3, line 3; column 4, lines 5-10; and Claim 1 at column 7, line 26 through column 8, line 20.)

It is respectfully submitted that the preceding amendment to Claim 1 makes it readily apparent that the present invention does **not** neutralize the acid catalyst (i.e. HCl) which is used to promote the reaction between the aniline and formaldehyde in

step a). As disclosed on page 4, lines 1-4 of the present application, an object of the present invention was to reduce or avoid the consumption of acidic catalyst and correspondingly of base for neutralizing the acidic catalyst at the MDA stage of the process. It is also evident from the specification on page 5, lines 16-19 and page 9, line 29 through page 10, line 3, that the process of the invention does not require neutralization of the acidic catalyst present in the polyamines of the diphenylmethane series before they are phosgenated to form the corresponding polyisocyanates. Accordingly, the presently claimed process avoids or eliminates waste water streams which contain salts and the associated reprocessing of these streams and their disposal costs.

In accordance with the present invention, the HCl used as a catalyst in the condensation reaction between aniline and formaldehyde can be recovered during the phosgenation of the polyamines to the corresponding polyisocyanates. This recovered HCl catalyst is then recycled back to MDA process.

Applicants further submit that the present amendment to Claim 1 makes it readily apparent that the reaction mixture which is phosgenated in step (c) of the presently claimed process comprises polyamines of the diphenylmethane series, HCl, 10 wt.% of aniline or less, and 5 wt.% of water or less. Thus, it is evident that phosgenation of the polyamines of the diphenylmethane series in the present invention is what yields the polyisocyanates of the diphenylmethane series.

It is respectfully submitted that the presently claimed invention is not rendered obvious by the DE 2404775 reference. As discussed above, this process adds liquid hydrogen chloride to the polyamine/polyamine hydrochloride mixture which transfers all amino functional groups into hydrochloride functional groups, thus forming the polyamine hydrochloride. This polyamine hydrochloride is then phosgenated to form the polyisocyanate.

By comparison, the presently claimed process does not add liquid hydrogen chloride to the polyamines and thus, does not form polyamine hydrochlorides. Rather, the polyamines are directly phosgenated to yield the corresponding polyisocyanates in accordance with the present invention.

Applicants' invention is simpler, more direct, and less expensive and less time consuming than the process of DE 2404775 (the Fuchs et al reference). It also does

not require the addition of liquid hydrogen chloride (at -100 °C) as in the DE 2404775 reference which requires special handling. Accordingly, this reference does not render the presently claimed invention obvious under 35 U.S.C. 103(a).

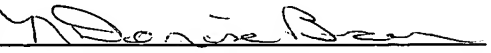
Applicants respectfully submit that the references GB 1203546, the Konig et al reference (U.S. 5,301,769) and the Keggenhoff et al reference (U.S. 4,597,909) all require that the acidic catalyst, i.e. the HCl catalyst, which is used to promote the reaction between aniline and formaldehyde, must be neutralized at some point prior to the phosgenation of the polyamines to polyisocyanates. In GB 1203546, see page 1, lines 70-82; in the Konig et al reference, see column 1, line 51 through column 2, line 16; column 4, lines 41-47; and Claim 1 at column 6, lines 13-37; and in the Keggenhoff et al reference, see column 2, line 39 through column 3, line 3; column 4, lines 5-10; and Claim 1 at column 7, line 26 through column 8, line 20. Applicants respectfully submit that these three references do not disclose or suggest eliminating the step in which the HCl (or other acidic) catalyst is neutralized as in the presently claimed invention.

These three (3) references clearly do not provide any suggestion to one of ordinary skill in the art to proceed in the manner which Applicants have and to eliminate the neutralization of the acidic catalyst. There is simply no information in any of these three references which supports the conclusion that the skilled artisan would act in a manner that is contrary to what is expressly disclosed by each of these three references.

It is respectfully submitted by Applicants that these references do not fairly suggest the presently claimed invention to one of ordinary skill in the art. Accordingly, these rejections are improper and it is requested that they be withdrawn.

In view of the above amendments and remarks, Applicants respectfully request the allowance of Claims 1-9.

Respectfully submitted,

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